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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

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APPEAL BRIEF OF Yunzhou Li
FOR
MULTICAST ROUTING

Serial No. 09/362,521
Filed: July 28, 1999

Appeal from a decision of the Primary Examiner dated November 20, 2002
Technology Center 2142
Examiner B. Prieto

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TABLE OF AUTHORITIES

I. Real Party in Interest

The real party in interest is Nortel Networks, Limited.

II. Related Appeals and Interferences

Appellants are not aware of any appeals or interferences that are related to the present case.

III. Status of the Claims

This is an appeal brief from a decision by the Primary Examiner dated November 20, 2002, finally rejecting claims 1-7, 9-13, 15-20 and 22, current pending in the present application. No claims have been allowed. Claims 1-7, 9-13, 15-20 and 22 are the subject of this appeal.

A notice of Appeal was filed on February 14, 2003.

IV. Status of Amendments

In the Final Office Action dated November 20, 2002, claim 1 was rejected under 35 U.S.C. §103(a) as being unpatentable over Crawley et al , U.S. Patent No. 5,881,246. Claims 2-7, 9-13, 15-20 and 22 were rejected under 35 U.S.C. §103(a) as being unpatentable over Crawley in view of Haggerty et. al. U.S. Patent No. 6,331,983.

On February 14th Appellants filed a response amending claim 13 and providing formal drawings. On February 19th Appellants filed a further response pursuant 37 C.F.R. 1.116(a) to enter arguments for the case. On March 4th the Examiner entered an Advisory Action, accepting the amendment to claim 13 and the drawings, and providing feedback regarding Appellants' argument.

V. Summary of the Invention

A. Background

Computer networks enable computers on opposite sides of the world to communicate by exchange of email, internet web-pages and other forms of electronic data transfer. Typically the electronic information is stored in packets. A packet is like an envelope with a return address (packet source) and a mailing address (packet destination). Much as an envelope reaches its mailing address via a series of post offices, a network packet reaches its destination by winding its way through different computers in the network.

One type of computer is known as a router. When a router receives a network packet, the router typically tries to figure out how to send the packet to its destination in the least amount of time.

Using a packet protocol referred to as Open Short Path First (OSPF) protocol, each router generates a link state advertisement (LSA) packet that includes data describing the cost of reaching connected routers. After generating a LSA packet, each router sends its LSA packet to other routers in the network, thus, each router continually receives LSA packets from other routers, each packet describing a small patch of the network. Each router knits the patches together to gain a complete picture of the network.

Unicast routing can quickly deliver a packet from a single source to a single destination. Sometimes, however, it is advantageous to send the same message from a single source to multiple receivers, using multicasting. For example, as shown in Figure 4 of the present application, when source 112 sends a multicast packet to receivers 110a

and 110b, the paths to the two receivers overlap through router 102a until the path reaches router 102c. Router 102c makes a copy of the multicast packet and forwards one copy to receiver 110a via link 104d and a second copy to receiver 110b via link 104g. Multicasting reduces the number of packets traveling in a network by allowing shared transmission paths (such as path 104b between router 102a and 102c) for multicast packets when available. (Specification, page 5, Figure 4).

One protocol that supports multicasting is the Protocol Independent Multicasting (PIM). PIM protocol is an attempt to provide a multicasting protocol that does not rely on a particular unicast protocol. Figure 5 illustrates a network of routers 102a-102h conforming to the PIM protocol. A source 130 sends a packet to PIM router 102a for multicast group members 132a, 132b. In reverse path forwarding, a router that receives a packet determines whether the packet arrived via a link on the short path tree. If so, the router transmits the received packet on all its network connections, save the connection that delivered the packet to the router. If the packet did not travel over the short path tree, the receiving router drops the packet. Typically a router 102b can determine whether the arrival of a packet from router 102a via link 104a is a path on the unicast short path tree by examining its unicast routing table. For example, in Figure 5, router 120d will drop a packet X which does not arrive on the "short path" link. In fact, if the short path is from router 102c, router 102d will drop all packets that are not received from router 102c.

When all routers in a network are not running PIM, a problem can occur. For example, in Figure 7 when PIM router 102i receives a packet from PIM source 130, router 102i transmits the packet to router 102j over connection 104q and to router 102k over connection 104o. Router 102k does not support PIM multicasting and simply drops

the received packet. Router 102j receives the packet from router 102i and forwards the packet to router 102l. When router 102l examines a unicast routing table to perform reverse path forwarding, router 102l determines that the packet did not come via the short path in the unicast short path tree (i.e., link 104p). Router 102l drops the packet and PIM multicasting fails to deliver the packet to the designated receiver.

B. Appellants' Invention

Appellant's invention for overcoming the above problem is shown in Figure 8. The Multicast OSPF protocol (MOSPF) adds a Multicast Capable (MC) bit to the link state advertisements of OSPF. Thus, routers that use MOSPF to gather link state advertisements *also* gather information regarding which routers in the network support multicasting. Thus, the link state advertisements can be used to generate a multicast routing table, comprising only multicast routers, in addition to the unicast routing table. Software then can configure a router to use the multicast routing table, rather than the unicast routing table, to perform reverse path forwarding calculations for multicast packets. Figure 9 shows a process 200 for building a multicast routing table. After receiving a link state advertisement 202, a router can update its unicast routing table 204. If the link state advertisement includes a multicast bit 206, the router can also update the multicast routing table 208 by determining the multicast short path tree through multicast capable routers (e.g., those routers setting the MC bit). By having an alternate routing table to use for multicast transmissions, the problems of the prior art are avoided.

VI. Issue

A. Whether claim 1 was properly rejected under 35 U.S.C. §103(a) in view of Crawley, U.S. Patent No. 5,881,246.

B. Whether claims 2-7, 9-13, 15-20 and 22 were properly rejected under 35 U.S.C. §103(a) in view of the combination of Crawley, U.S. Patent 5,881,246 and Haggerty et al. U.S. Patent No. 6,331,983.

VII. Grouping of Claims

Claims 1-7, 9-13, 15-20 and 22 do not stand or fall together, and will be argued separately.

VIII. Argument

A. The Examiner has failed to establish a prima facie case of obviousness under 35 U.S.C. §103 of claim 1 as being unpatentable over Crawley.

"To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all of the claim limitations."

i.) There is no suggestion or motivation for the modification suggested by the Examiner

It is well established that, in order to support a rejection under 35 U.S.C. §103, sufficient motivation for combining the references to reach the combined modification must be shown by the Examiner. The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination *In re Mills, 916* F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990). A statement that modifications of the prior art to meet the claimed invention would have been "well within the ordinary skill of the art at the time the claimed invention was made" because the references relied on teach that all aspects of the claimed invention were individually known in the art is not sufficient to establish prima facie case of obviousness without some objective reason to combine the teachings of the references. *Ex parte Levengood,* 28 USPQ2d 1300 (Bd. Pat. App. & Inter. 1993).

Appellants submit that the Examiner has failed to provide the necessary motivation to modify the references through combination. Appellants' claim 1 recites "... A method of multicast routing comprising ... receiving link state advertisements from routers in a network... and constructing a multicast routing table and a unicast routing table from the received link state packets, the tables corresponding to a short path tree through multicast routers..." The Examiner admits, in the final office action, that Crawley neither describes nor suggests the use of the two routing tables, but states that it would be obvious to modify Crawley to include two tables because it would "thereby reduce the resources for storing, network advertisements necessary for routing calculations, as taught by Crawley..." As Appellants responded in the response to the final office action

dated February 19, 2003, Appellants fail to see how the use of two routing tables would 'reduces resources for storing network advertisements...', and reaffirm their submission that the motivation for the modification to increase the data storage by providing two routing tables is neither shown nor suggested by Crawley for the following reasons.

In the Advisory Action, mailed March 4, 2003, the Examiner stated in response to the above argument:

"... Applicant argues (c) in regards to claim 1, that there is no motivation presented ... because applicant fails to see how the use of two routing tables would reduce resources for storing network advertisement... In response to argument (c) ... the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so .... In this case, motivation was provided by the reference, see Crawley col. 2/lines 24-54..."

Appellants have carefully reviewed the cited passage of Crawley, but fail to find further motivation for the modification in that portion of the text. Column 2, lines 24-54 describes:

> "... The present invention provides an explicit routing system for reducing the routing calculations and, thereby, reducing the resources used to generate, receive, process, and store network advertisements necessary for routing calculations. Explicit routing allows a specific router ... to calculate the entire path through a network for a particular data flow. When calculated, the path and routing instructions are provided to all other routers on the path. Therefore, the other routers do not need to calculate a path through the network because the router has provided an explicit path for the routers to follow. Additionally, only the specific router needs to receive, store, and process the advertisements needed for route calculation.

> An embodiment of the present invention uses a specific router to select a path through a connectionless network. Explicit routing advertisements (ERAs) are generated by the specific router and contain information regarding the selected path through the network. The ERA is forwarded to the first hop router. Each router installs the forwarding state described in the ERA, creates new ERAs for each of its next hop routers, and forwards the ERAs. This process continues until all routers on the path have installed routing state...."

Appellants have carefully examined this portion of Crawley, but submit that it only serves to strengthen Appellants argument that Crawley would *not* be motivated to increase routing information storage at each device, as the overall goal is explicitly stated as "... reducing the resources used to generate, receive, process, and store network advertisements necessary for routing calculations..." It is accepted that if the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959). In the present case, Appellants assert that the proposed modification of Crawley (to include an additional table) would change the principle of operation of Crawley (reducing resources), and accordingly for at least this reason, the rejection under 35 U.S.C. §103 cannot stand.

ii). *Prior art does not teach all of the limitations of the claimed invention*

In particular, Crawley neither describes nor suggests "..... and constructing a multicast routing table and a unicast routing table from the received link state packets..." as recited in claim 1.

As is clear from the portion of text of Crawley replicated above, Crawley describes a system for providing explicit routing functions in a connectionless network, where "only a specific router needs to receive, store, and process the advertisements needed for route calculation..." and where path and routing instructions, when calculated, are provided to all other routers on the path. (col. 2, lines 34-38). Appellants note that no mention is made in Crawley of 'constructing a multicast routing table and a unicast routing table...' as recited in claim 1, although Crawley does discuss Open Short Path First (OSPF) and Multicast Open Short Path First (MOSPF) protocol in the background of the invention section. In the Background of Crawley it is described:

"... The specific topology of a particular area is not broadcast to other areas. Instead, a summary of the area is transmitted to other areas, thereby reducing the amount of link-state information transmitted through the network. When a router is connected to more than one area, it maintains a separate topology database for each connected area. A separate execution of OSPF's basic routing area is performed in each area. Additionally, routing within a particular area is determined only the topology of the particular area..." (Crawley, col. 1, lines 42-56). Accordingly, Appellants would submit that databases are maintained in Crawly according to areas, rather than according to whether the data is a unicast or multicast packet. Crawley also mentions MOSPF, but is silent as to whether an area would include both types of protocols.

Accordingly, for at least the reason that Crawley neither describes nor suggests "... constructing a multicast routing table and a unicast routing table from the received link state packets, the tables corresponding to a short path tree through multicast

routers..." claim 1 is patentably distinct over Crawley and it is respectfully requested that the rejection should be withdrawn.

The Examiner has provided a reasoned explanation of the position that Crawley teaches a unicast routing table and a multicast routing table in the Advisor Action mailed on March 4, 2003. The explanation provided by the Examiner is that:

> "... In response to the argument" that the prior art does not teach ... constructing a multicast and unicast routing table "it is respectfully noted that in accordance with MPEP §2106 Patentability Office personnel must rely on the applicant's disclosure to properly determine the meaning of terms used in the claims ... as a way by which uncertainties of claim scope may be removed, as much as possible, during the administrative process.
>
> Therefore claim (1) reads constructing an orderly arrangement of data (table) (called "multicast routing table" and "unicast routing table") from the received link information (state) packets, and table corresponding to information regarding the links, routes and cost (i.e., a short path tree) through interconnecting device with routing capabilities to multiple destinations (multicast routers) (see specification page 4, line 3 to page 6, line 10).
>
> Prior art teaches constructing a routing table (database topology of (link-state advertisement (LSA) broadcast, i.e., from routers in network area to support routing algorithms) from the received link state (advertisement) packets, the table corresponding to a short path tree through unicast routers (OSPF: col. 1/lines 27-43 [Crawley], database of the network topology using a link state routing topology, i.e., unicast group members), constructing an unicast routing table from the received link state advertisements (Haggerty: col 10/lines 56-col. 11/line 19) ; and constructing an added new routing table (database topology of (link-state advertisement (LSA) broadcast, i.e., from routers in network area) from the received link state (advertisement) packets, the table corresponding to a short path tree through multicast routers (MOSPF col. 1/lines 56-col. 2 line 11). "

Appellants have two responses to the Examiner's position stated in the advisory action. First, although the Examiner has carefully examined the specification in an effort to find support for the claim language, it does not appear that patentable weight has been given to the two very different 'unicast' and 'multicast' routing tables. As stated in the specification, page 8, lines 3-5 "... The MOSPF (Multicast Open Short Path First) protocol adds an "MC" (multicast capable) bit to the link state advertisement of OSPF>.

If PIM routers ... use MOSPF to generate link state advertisements ... PIM router 1021 will receive not only the arrangement and costs of connections in the network, but also information describing which routers support multicasting. Using the information received from the link state advertisements, router 1021 can generate a multicast routing table 1081 in addition to a unicast routing table 1821. For example, the router 1021 can use Dijkstra's short path tree algorithm to determine a multicast short path tree that connects only the multicast routers. The multicast short path tree typically differs from the unicast short path tree..." Thus, the grouping of the unicast and multicast tables into one entity, as suggested by the Examiner, does not give patentable weight to the two different tables.

Second, as stated above, although Crawley mentions both the OSPF and MOSPF protocols, there are no hints or suggestions as to how Crawley would operate in a situation where both protocols are operating at the same time. Appellants assert that the Examiner's statement that Crawley teaches 'constructing an added new routing table', in addition to any other routing table, is just not shown in the references. Although Crawley does describe adding a 'new type of LSA', there is no mention as to how databases are organized, other than by area. Accordingly, for at least these reasons, Appellants maintain their position that Crawley fails to teach or describe the limitations of the present invention.

B. The Examiner has failed to establish a prima facie case of obviousness under 35 U.S.C. §103 of claims 2-7,9-13, 15-20 and 22 as being unpatentable over Crawley in view of Haggerty, U.S. Patent 6,331,983B1.

i). Combination neither describes nor suggests claimed invention

Haggerty describes a method wherein a source receives a multicast packet on an access port, determines a group address of the packet and composes a 'sender present' to other switches in the network. The receiving switches determine whether a local host wishes to join the group and, if so, send a map message back to the source switch. A map message may terminate at a switch on the path that already has a connection for the source/group pair and join into this connection as an additional output port. In this manner, a "signal out, connect back" method is provided for establishing a connection path from the sender to multiple receivers. (Haggerty, Abstract).

Appellants' claim 2 recites "The method of claim 1 further comprising the step of performing reverse path forwarding using the multicast routing table..."Appellants independent claims 13 and 17 include similar limitations.

Haggerty is particularly and solely directed towards multicast traffic, and is silent as to the inclusion of a unicast routing table and multicast routing table as recited in each of the independent claims. Accordingly, for at least this reason, claims 2-7, 9-13, 15-20 and 22 are patentably distinct over the combination of Crawley and Haggerty, and Appellants therefore request withdrawal of the rejection.

IX. Conclusion

Appellant submits therefore that the rejection of claims 1-7, 9-13, 15-20 and 22 under 35 U.S.C. § 103 is improper for failing to provide a combination that teaches all elements of the claims and for failing to provide sufficient motivation to combine the two references.

It is therefore respectfully requested that the Board reverse the Examiner's rejections under 35 U.S.C. §103.

Respectfully submitted,

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1. (Amended) A method of multicast routing, comprising:

receiving link state advertisements from routers in a network; and

constructing a multicast routing table and a unicast routing table from the received link state packets, and tables corresponding to a short path tree through multicast routers.

2. The method of claim 1, further comprising performing reverse path forwarding using the multicast routing table.

3. The method of claim 1 wherein the link state advertisements comprise OSPF (Open Short Path First) link state advertisements.

4. The method of claim 1 wherein the link state advertisements comprise MOSPF (Multicast Open Short Path First) link state advertisements.

5. The method of claim 1 wherein constructing the multicast routing table comprises determining if a router is a multicast router.

6. The method of claim 1 wherein constructing the multicast routing table comprises using Dijkstra's short path algorithm.

7. The method of claim 1 wherein the multicast routing table correlates addresses of destination multicast capable routers with addresses of multicast capable routers on a short path tree of multicast capable routers.

8. Cancelled.

9. The method of claim 1 wherein using the multicast routing table comprises configuring PIM (Protocol Independent Multicasting) to use the multicast routing table.

10. The method of claim 9 wherein configuring comprises providing a routine for a PIM RPF_Check function.

11. The method of claim 8 wherein PIM uses the multicast routing table to perform reverse path forwarding in sparse mode.

12. The method of claim 8, wherein PIM uses the multicast routing table to perform reverse path forwarding in dense mode.

13. (Twice Amended) A method of multicast routing, comprising:

receiving MOSPF (Multicast Open Short Path First) link state advertisements from routers in a network;

constructing a multicast routing table and a unicast routing table from the received link state packets, the multicast routing table correlating addresses of destination multicast capable routers with addresses of multicast capable routers on a short path tree of multicast capable routers; and

performing reverse path forwarding using the multicast routing table.

14. Cancelled.

15. The method of claim 13 wherein multicast routing comprising routing in accordance with the Protocol Independent Multicasting (PIM) protocol.

16. The method of claim 13 wherein multicast routing comprising routing in accordance with the Protocol Independent Multicasting (PIM) protocol.

17. (Amended) A computer program product, disposed on a computer readable medium, for multicast routing, the computer program including instructions for causing a computer to:
receive link state advertisements from routers in a network;

construct a multicast routing table and a unicast routing table from the received link state packets, the tables corresponding to a short path tree through multicast routers.

18. The computer program of claim 17 further comprising instructions for performing reverse path forwarding using the multicast routing table.

19. The computer program of claim 17 wherein the link state advertisements comprise MOFPF (Multicast Open Short Path First) link state advertisements.

20. The computer program of claim 17 wherein the multicast routing table correlates addresses of destination multicast capable routers with addresses of multicast capable routers on a short path tree of multicast capable routers.

21. Cancelled.

22. The computer program of claim 17 wherein multicast routing comprises multicast routing using the Protocol Independent Multicasting (PIM) protocol.